

An aerial photograph of a forest, likely Douglas-fir, with a grid overlay. The grid is composed of thin white lines forming a rectangular pattern across the forest canopy. The forest appears dense with some lighter patches, possibly indicating areas affected by outbreaks.

The DOUGLAS - FIR TUSSOCK MOTH
in the
NORTHERN REGION
A cartographic history of outbreaks from
1928 to 1973

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
DIVISION OF STATE AND PRIVATE FORESTRY - NORTHERN REGION

Missoula, Montana
Report No. 73-27

December 1973
5200

Cover photo: Grand fir stand severely defoliated by the Douglas-fir
tussock moth.

THE DOUGLAS-FIR TUSSOCK MOTH IN THE
NORTHERN REGION--A CARTOGRAPHIC HISTORY
OF OUTBREAKS FROM 1928 TO 1973

by

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ABSTRACT

The Douglas-fir tussock moth, *Orgyia pseudotsugata* McD., periodically defoliates Douglas-fir, true firs, and other host trees in forests of the western United States. In the Northern Region, these infestations occur about once every decade.

This history covers the earliest recorded outbreak in northeastern Washington from 1928 to 1930 and includes information about outbreaks in northern Idaho and eastern Washington from 1944 to 1947, northeastern Washington and northern Idaho from 1950 to 1955, northern Idaho and western Montana from 1961 to 1965, and the current outbreak in northern Idaho, northeastern Washington, and western Montana which began in 1970.

These outbreaks usually last from 2 to 4 years in forested areas and typically go through a buildup phase the first year, an outbreak phase the second year, and a declining phase the third year due to parasites and/or polyhedrosis virus. Exceptions are: It may take an outbreak 2 years to build up or occasionally natural control agents can cause a population collapse at the end of the second year.

INTRODUCTION

The Douglas-fir tussock moth, *Orgyia pseudotsugata* McD., is a defoliator of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, and true fir, *Abies* sp., forests in the western United States. Larvae (fig. 1) can feed on new foliage and older growth; consequently, heavy larval populations are capable of completely defoliating and killing trees in a single growing season (fig. 2). The tussock moth, then, is one of the most potentially destructive forest defoliators in the western United States.

This insect species was first recorded severely defoliating Douglas-fir near Chase, British Columbia, Canada, in 1918 (Evenden and Jost 1946). Since then, major epidemics have occurred every decade in the fir forests of western North America as Wickman's et al. (1973) history of epidemics in Oregon and California and this report illustrate.

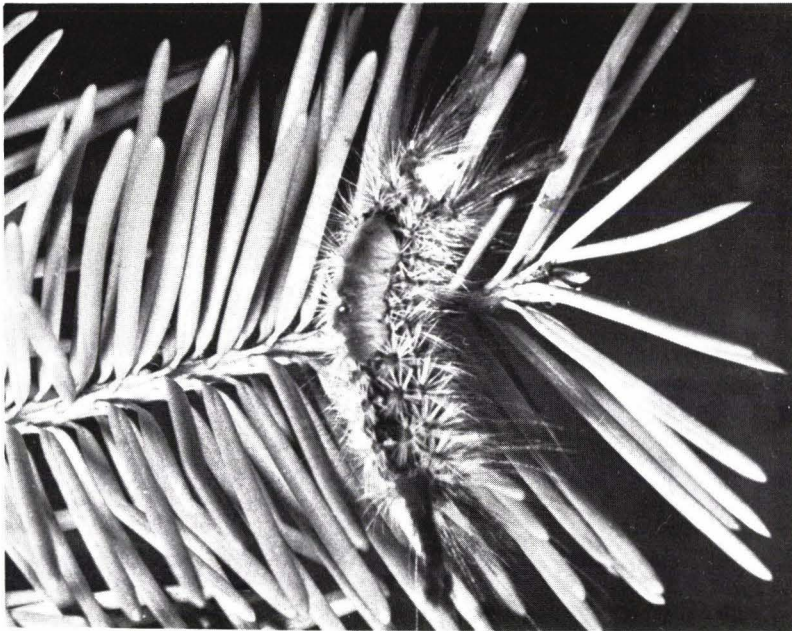


Figure 1.--Fully grown Douglas-fir tussock moth larva feeding on current needles of a fir tree.



Figure 2.--Mixed fir stand in northern Idaho heavily defoliated by the Douglas-fir tussock moth.

Recording the history of Douglas-fir tussock moth epidemics in the Northern Region at this time coincides with a severe epidemic in Oregon and Washington, and the beginning of one in northern Idaho which is a part of the Northern Region.

PAST OUTBREAKS

Northeastern Washington, 1928-1930.--Between 1928 and 1929, a severe epidemic of Douglas-fir tussock moth developed throughout forested areas near Northport, Washington. This epidemic reached its peak on the Colville National Forest, Washington, in 1930, and by then had destroyed 300 million board feet of commercial timber (Evenden and Jost, 1946).

Northern Idaho and eastern Washington, 1944-1947.--Spot infestations in ornamental (fig. 3) and shelterbelt trees around farms and residences appeared in 1944. These spots were located at Rathdrum, Troy, Moscow Mountain, and Sandpoint, Idaho, and near Palouse, Washington. Additional spot infestations were recorded in 1945 near Farragut, Coeur d'Alene, Rathdrum, Worley, and Geneese, Idaho. Two forested areas were defoliated that year; 320 acres were infested near Viola, Idaho, and 80 acres 35 miles northwest of Viola between Fairfield and Latah, Washington, were damaged (Evenden and Jost, 1946).



Figure 3.--Ornamental fir trees with tops defoliated by the Douglas-fir tussock moth.

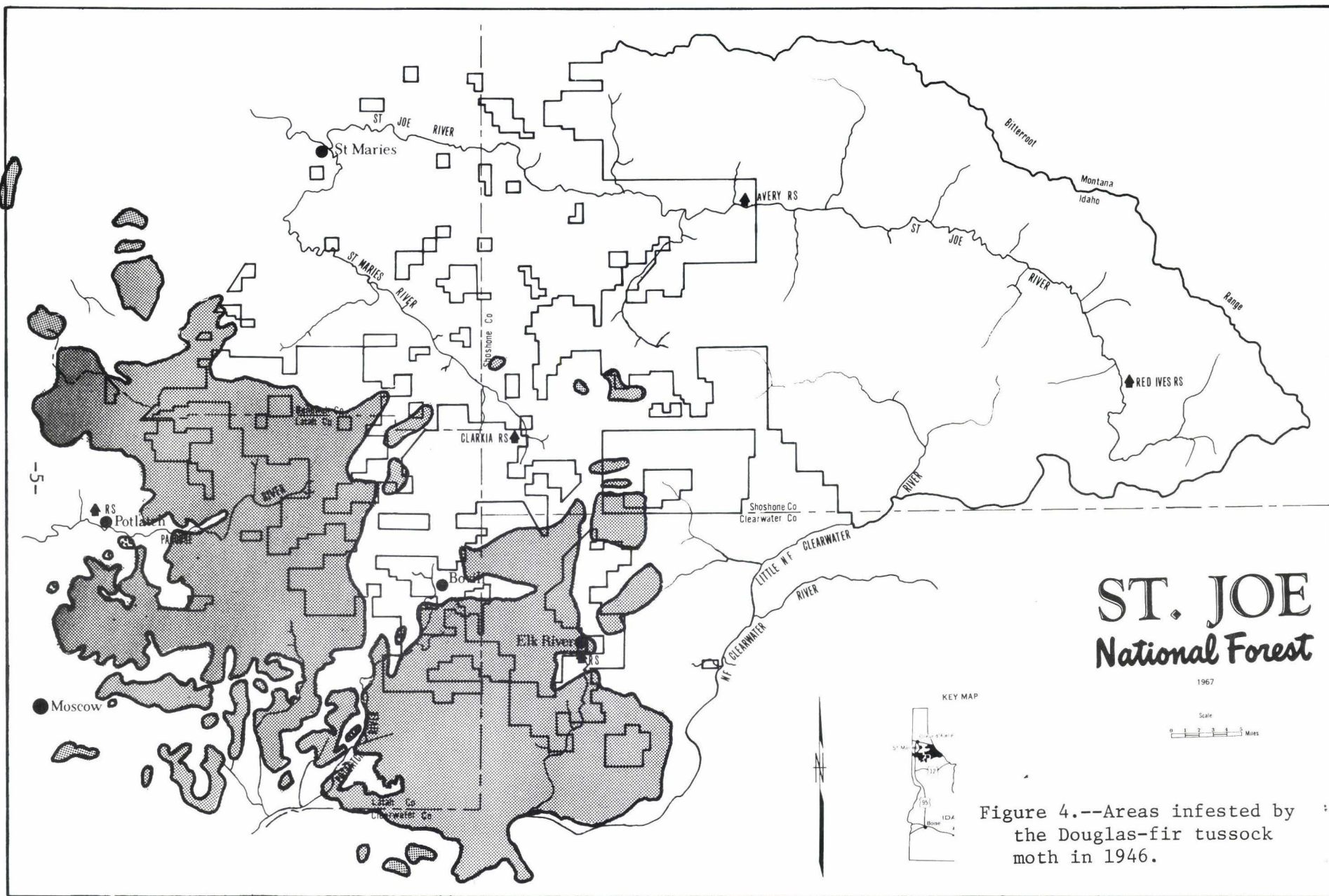
An aerial reconnaissance of the St. Joe National Forest, Idaho, was made in 1946 and tussock moth defoliation was visible over 350,000 acres in Clearwater, Latah, and Benewah Counties in Idaho (fig. 4). Host type was Douglas-fir, grand fir, *Abies grandis* (Dougl.) Lindl., and Engelmann spruce, *Picea engelmannii* Parry. A ground survey showed approximately 447,000 acres were infested with variable population levels of tussock moth larvae. This acreage was broken down into the following four classifications (Evenden and Jost, 1946):

	<u>Acres</u>
1. Heavy defoliation - injury varies from 50 percent to practically complete elimination of all foliage	150,000
2. Medium defoliation - injury varies from a complete defoliation of 3 to 4 feet of extreme top of tree to 50 percent of total foliage	70,000
3. Light defoliation - visible damage to new growth on limb and extreme top of tree	130,000
4. Insects present within area but no injury visible	97,000

In 1947, more than 400,000 acres were sprayed from the air with 1 pound of DDT in 1 gallon fuel oil per acre to control the tussock moth in northern Idaho. Spraying began on May 22 and terminated on July 2. No living larvae were found anywhere in the treated areas. This great success was attributed to spraying larvae when they were most susceptible--the first three instars. Workers estimated that spraying prevented the almost certain defoliation of host trees containing 1½ billion board feet of merchantable sawtimber valued at \$4,320,000, and host trees containing another 1.2 billion board feet immediately adjacent were saved from possible defoliation. In addition, 140,000 acres almost completely defoliated in 1946 were saved from being killed by additional defoliation in 1947 (Evenden and Jost, 1947).

Additional outbreaks were located during the summer of 1947 on 10,000 acres near Colville, Washington, and on some 20,000 acres east of Orofino, Idaho. A combination of polyhedrosis virus and parasites terminated both these infestations before moths could emerge in the late summer of 1947 (Johnson, 1949).

Northeastern Washington and northern Idaho, 1950-1955.--The Douglas-fir tussock moth was reported in scattered areas of Spokane, Pend Oreille, and Stevens Counties, Washington, in 1950 and 1954 (Gibson and Terrell, 1955).



An aerial survey of these counties in 1955 showed that about 9,075 acres were defoliated (fig. 5). In Stevens County, 75 areas of from 1 to 2,000 acres were detected; 10 spots in farm yards were observed in Spokane County; and two farm yards were infested in Pend Oreille County (Terrell, 1955). Also, in 1955, 30,600 acres had various degrees of defoliation east of Orofino, Idaho. Studies of the Washington-Orofino infestations during the winter of 1955-56 showed that parasitism of moth cocoons in all forested areas averaged 71.3 percent in Washington and 78.0 percent near Orofino. All these infestations reached their peak in 1955 and by the end of that year subsided (Dodge, 1956).

Northern Idaho and western Montana, 1961-1965.--In 1961, Douglas-fir, grand fir, and ornamental spruce trees near farms and private homes were heavily defoliated in Moscow, Clark Fork, and Bonners Ferry, Idaho. Nearly 50 percent of the infested trees in and near Bonners Ferry, and about 90 percent in Moscow were sprayed by private land-owners with various insecticides during the summer of 1961 (Tunnock, 1962). Aerial surveys of northern Idaho and northeastern Washington during 1962 detected infestation centers in or near Copeland, Moyie, Albeni Falls, Hayden Lake, Coeur d'Alene, St. Maries, Orofino, North Bonners Ferry, Idaho, and Colbert, Washington. Personnel of the Palouse Ranger District, St. Joe National Forest, Idaho, detected small numbers of larvae in some of their forested areas (Tunnock, 1963).

In 1963, surveys located four new infestations in addition to those described above. Six ornamental trees around a home near Algoma Lake south of Sandpoint, Idaho, contained current year egg masses. Forested areas near Mineral Mountain Lookout, north of Potlatch, Idaho, contained egg masses. About 1,400 acres of Douglas-fir southwest of Kalispell, Montana, were heavily defoliated for the first time. By the end of the summer a polyhedrosis virus killed most of the larvae in the northern portion of this infestation. Near Lion Lake, close to Hungry Horse Reservoir, Montana, about 10 acres of timbered land were infested. No 1963 egg masses were found, however (Tunnock, 1963).

There were indications that an epidemic was building up in northern Idaho when larvae were found on the Palouse District in 1962 and egg masses were present on Mineral Mountain in 1963. By 1964, defoliation visible from the air covered about 70,000 acres in Benewah and Latah Counties, Idaho. Ground surveys disclosed that the epidemic extended from Moscow to Coeur d'Alene Lake and covered a total of 191,000 acres. The number of acres defoliated near Kalispell, Montana, increased to 4,800, and about 250 acres of Douglas-fir were infested south of Polson, Montana. Several new spot infestations appeared in 1964 near Spirit Lake, Rathdrum, Hauser Lake, Mica, Idaho, and at Big Fork, Troy, Tally Lake, Bonita, and Missoula, Montana (Figs. 6, 7, and 8). Since 1961, tussock moth populations gradually subsided in the following Idaho towns due to spraying or natural causes: Moscow, Orofino, St. Maries, Algoma Lake, Albeni Falls, Coeur d'Alene, Moyie, and Clark Fork (Tunnock, 1964).

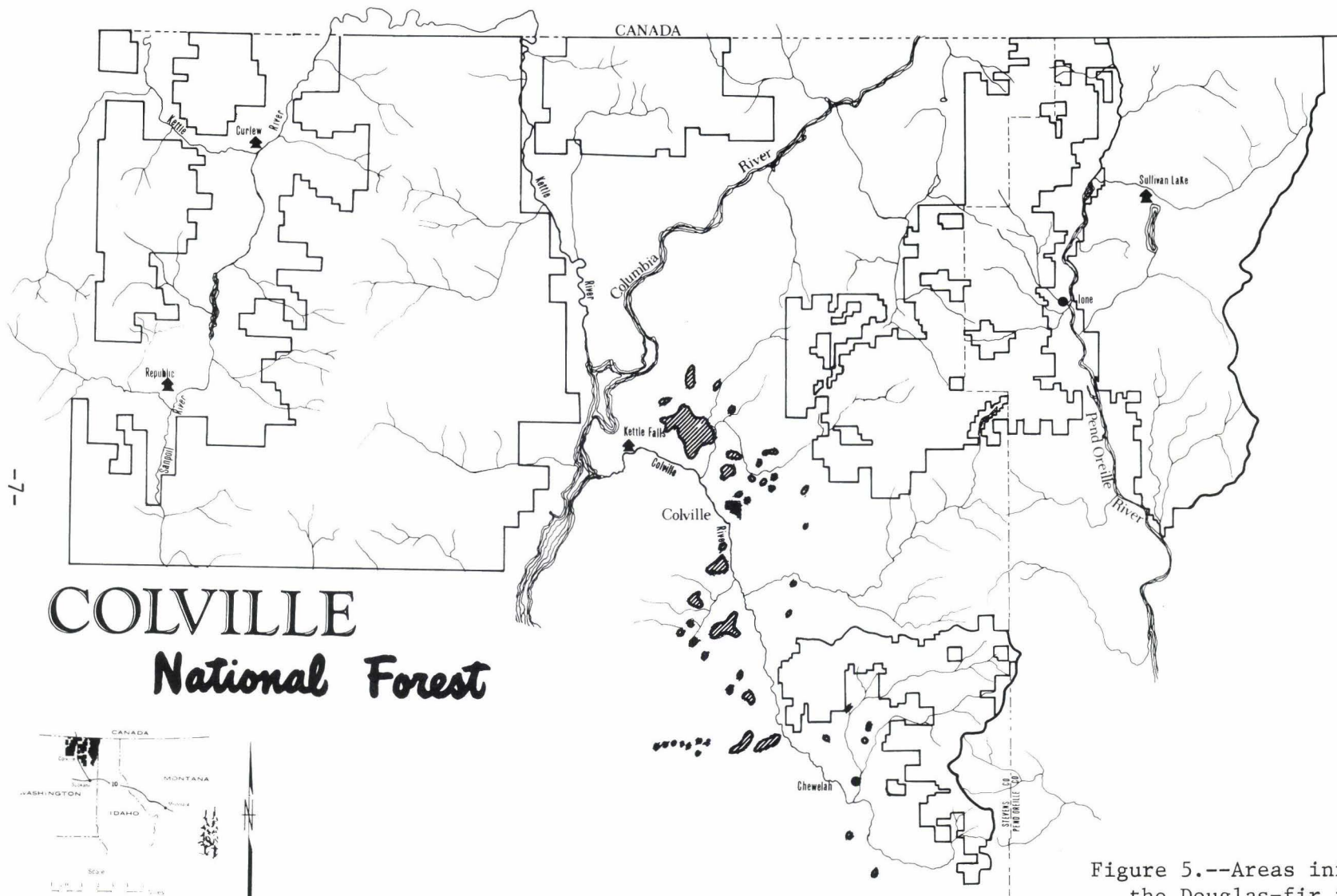
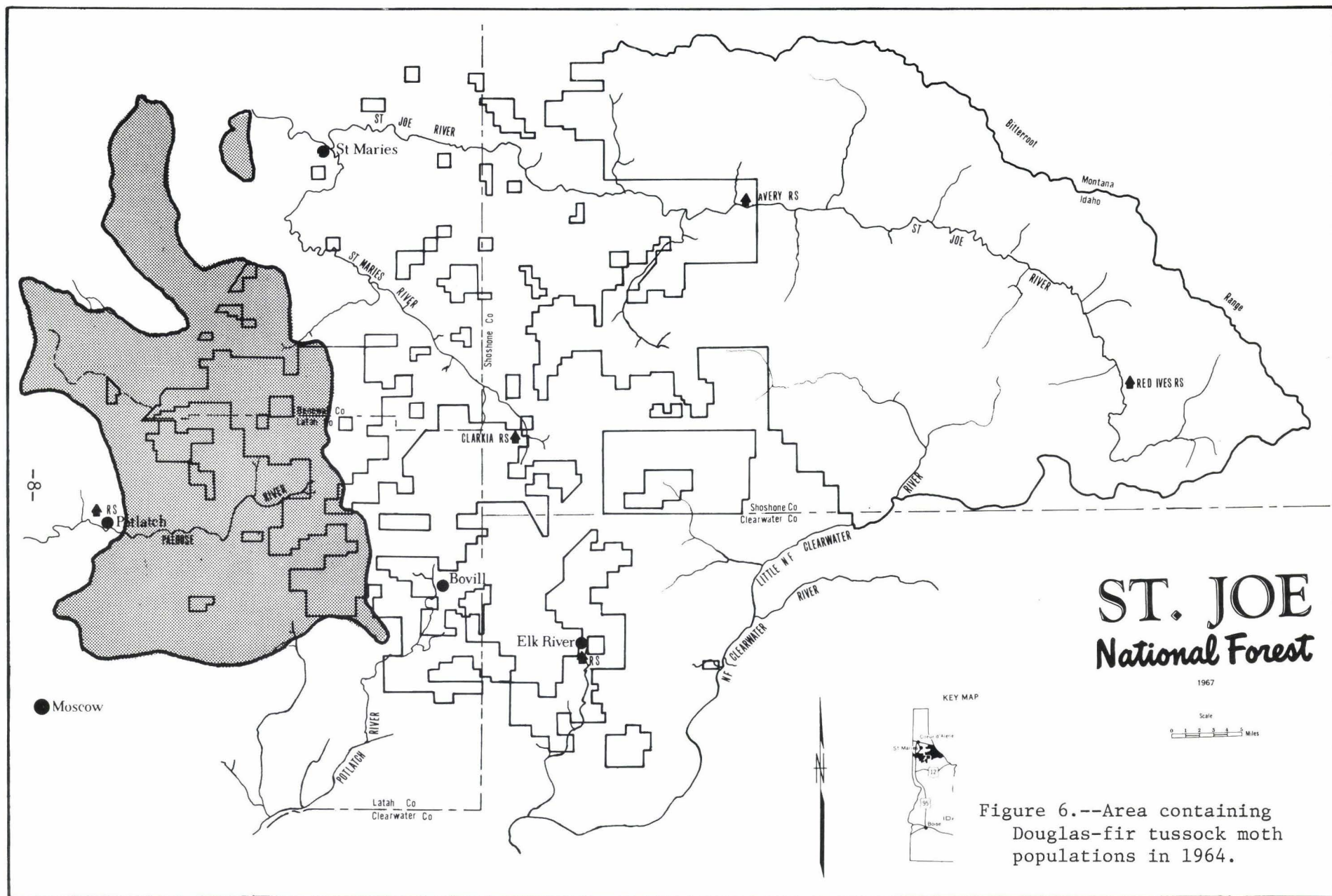
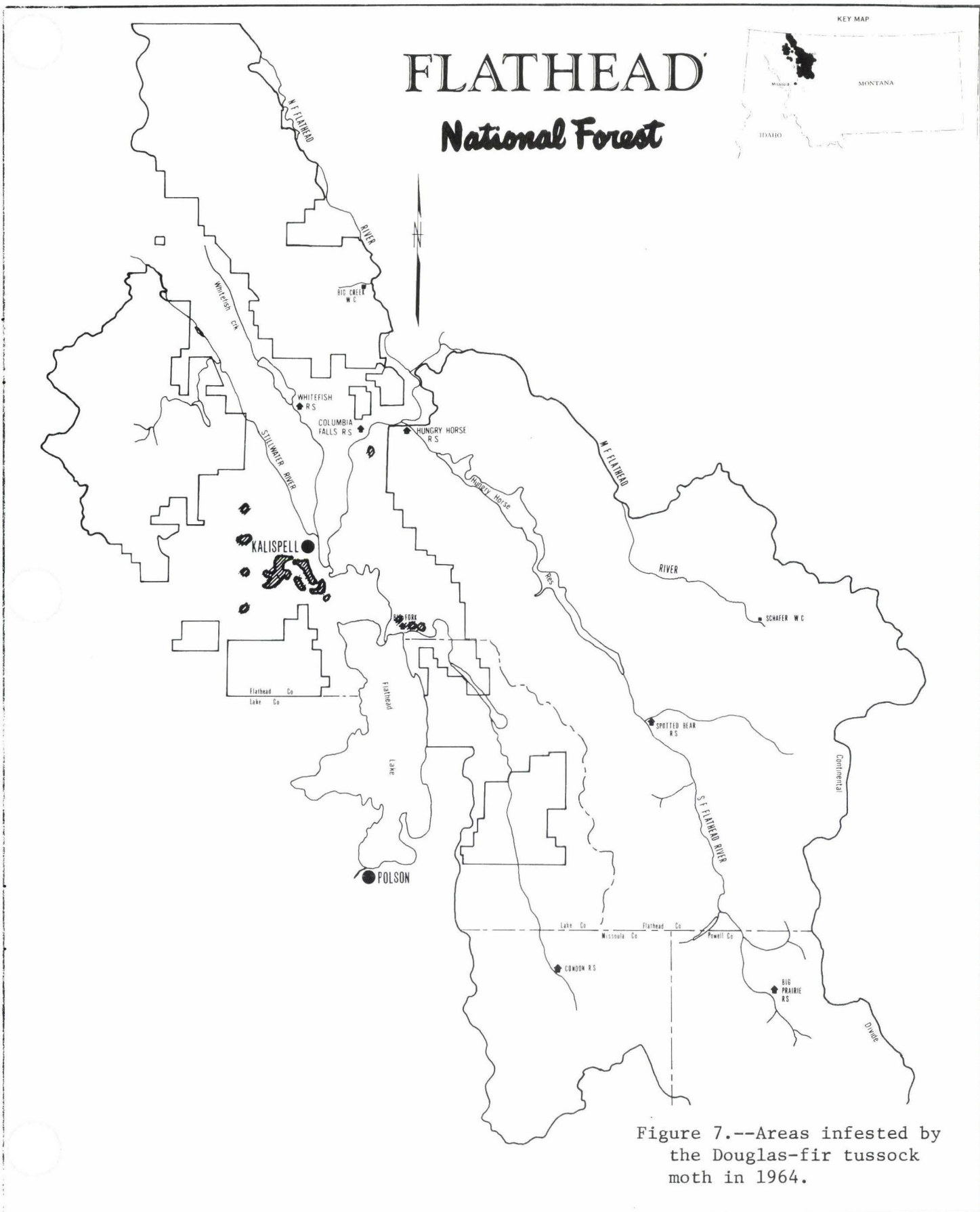


Figure 5.--Areas infested by the Douglas-fir tussock moth in 1955.





COEUR D'ALENE

National Forest

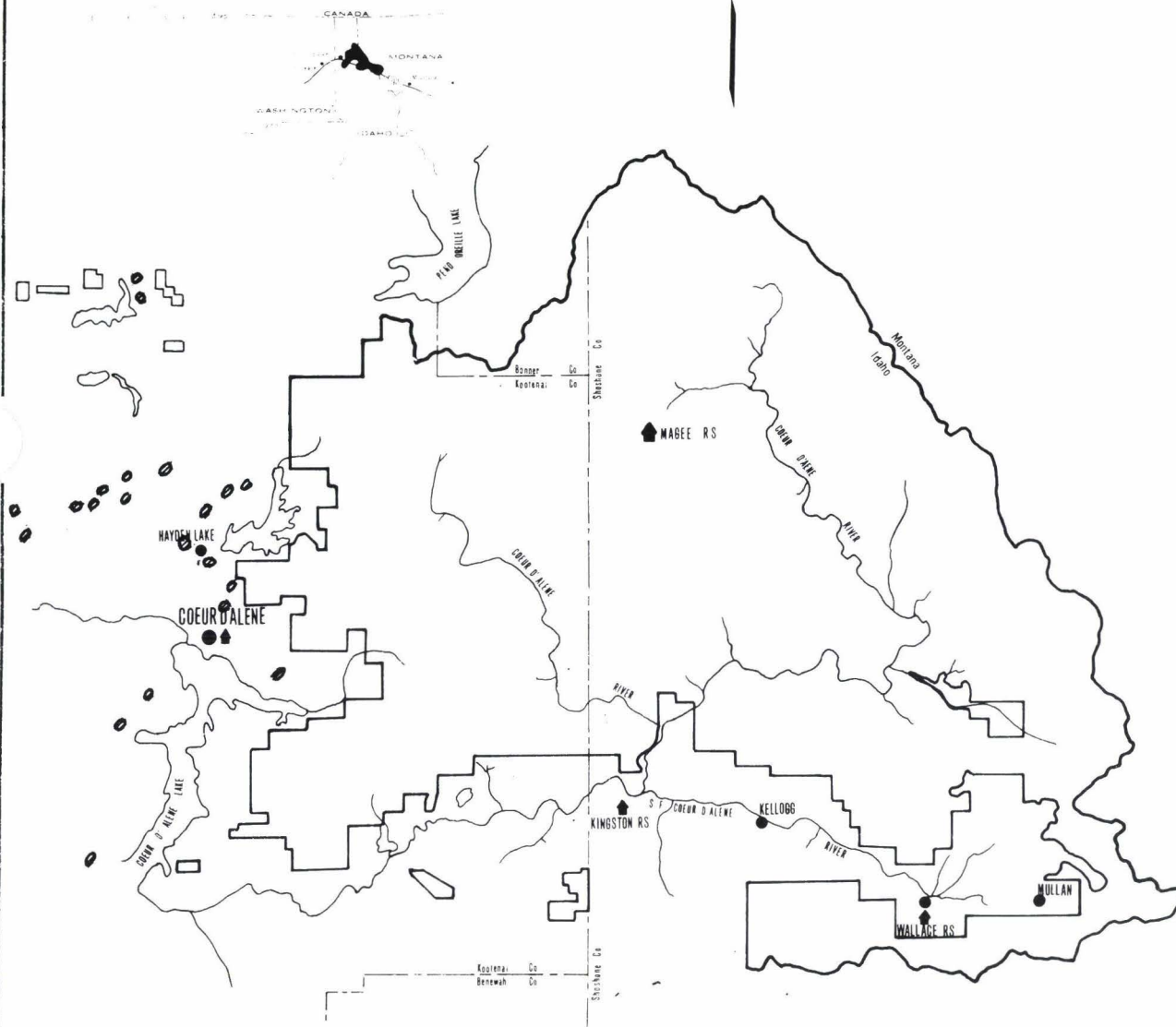


Figure 8.--Areas infested by the Douglas-fir tussock moth in 1964.

In 1965, tussock moth larvae caused various degrees of defoliation in only 50 of the 250 acres infested south of Polson, Montana, in 1964; in three new 10- to 40-acre areas south of Elmo, Montana; and within Benewah and Latah Counties, Idaho, the epidemic increased from 191,000 acres in 1964 to 225,000 acres in 1965 (figs. 9 and 10). A survey in October 1965 produced no current egg masses in Montana and only a few in Idaho. Observations showed that all the infestations had died out (Tunnock, 1965). Factors responsible for the collapse were nuclear polyhedrosis virus, parasites, and aerial applications of three-fourths pound of DDT per acre to about 120,000 acres in Idaho (Scribner, 1965). No infestations were found in 1966 in Montana or Idaho.

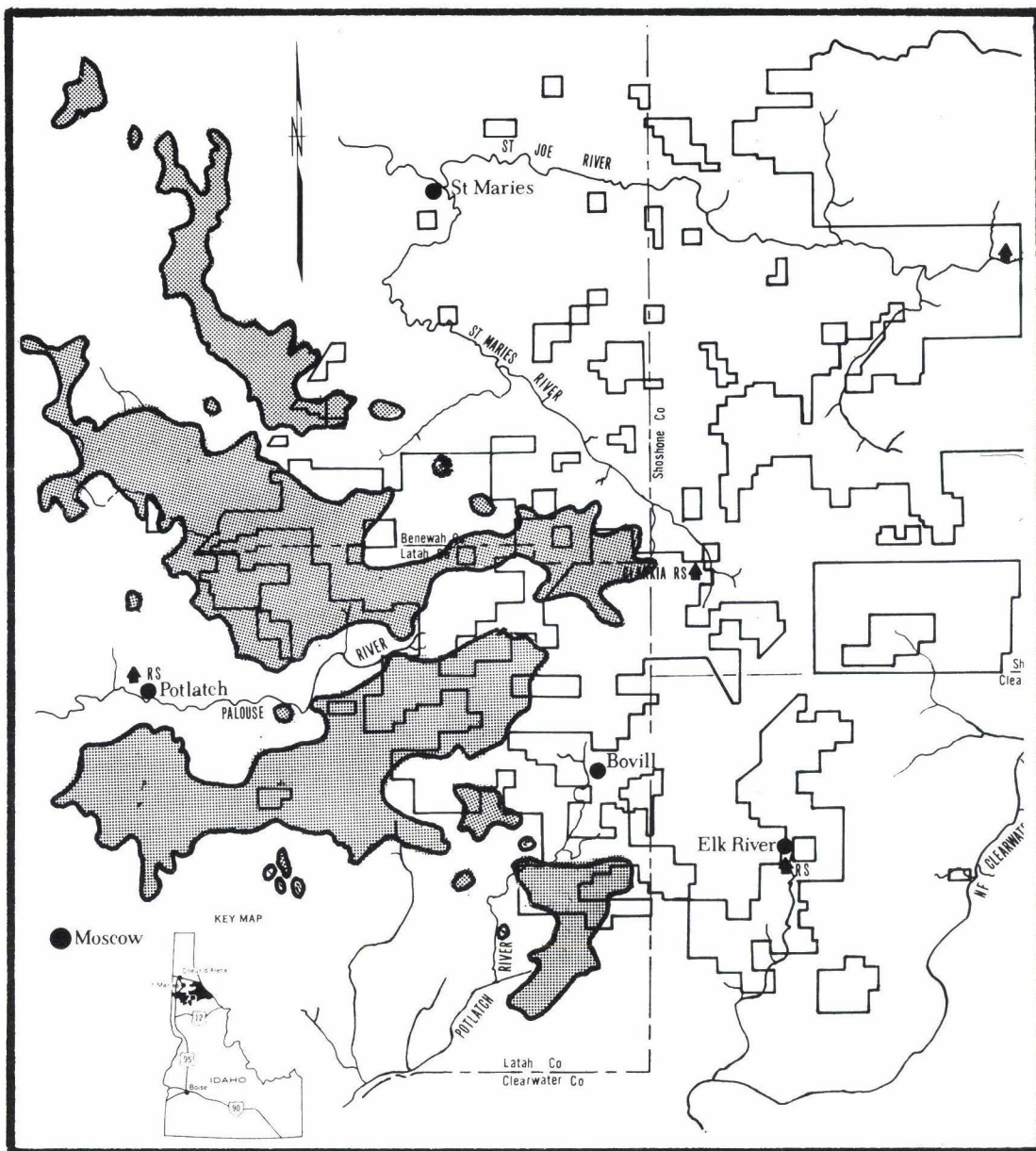


Figure 9.--Areas infested by the Douglas-fir tussock moth in 1965 on the St. Joe National Forest.



Figure 10.--Areas infested by the Douglas-fir tussock moth in 1965.

THE PRESENT OUTBREAK

Tussock moth populations were detected again in 1970 when several ornamental spruce were defoliated in Spokane, Washington, and Polson and Missoula, Montana. These infestations continued in 1971, and around several private homes in the Coeur d'Alene, Idaho, area grand fir, spruce, and Douglas-fir were defoliated (Tunnock and Honing, 1971).

In 1972, larvae were observed in individual trees in Spokane, Penix Canyon, and about 300 acres of defoliated Douglas-fir were sighted south of Kettle Falls, Washington, during the annual aerial insect and disease detection survey. Tussock moth reports in Idaho were scattered and confined mostly to ornamental trees. In Coeur d'Alene tussock moth larvae defoliated ornamental trees at 12 residential sites. Two ornamental spruce in a yard in Troy were defoliated, and damage was found along the Wolf Lodge Road, east of Coeur d'Alene, and in Post Falls and Moscow. Egg masses were numerous within a 100-acre logging area on Charles Butte, St. Joe National Forest, Idaho (Tunnock, 1972).

During February 1973, a cooperative egg mass survey involving Idaho Department of Public Lands and the U.S. Forest Service was made in Benewah and Latah Counties in northern Idaho which have a history of past tussock moth outbreaks. It was felt that if egg masses were present on Charles Butte, they could be present in other areas. Twenty-eight sample plots were examined for evidence of tussock moth egg masses. Cocoons or egg masses were found in sample trees on 11 of the plots and in three other areas. Based on the data gathered in this survey, various degrees of defoliation were predicted for four general areas. Extensive defoliation was expected along the Palouse Range and south and southeast of Mica Mountain. Heavier defoliation was predicted from Mineral Mountain along Skyline Drive to McCroskey State Park. The largest area of defoliation was expected along the Divide from Windfall Pass south to the North-South Ski Area (Livingston and Tunnock, 1973).

An aerial survey during July and August 1973 to detect Douglas-fir tussock moth defoliation in the Northern Region showed damage did occur in the four areas within Benewah and Latah Counties, but was even more widespread than expected (table 1) (Tunnock, et al., 1973).

This aerial survey revealed that in the recorded history of Douglas-fir tussock moth epidemics in the Northern Region forested areas were infested for the first time on the Coeur d'Alene and Nezperce National Forests and on private lands south of Lewiston in Idaho and on the Lolo National Forest, Montana (fig. 11).

Table 1.--Defoliation by the Douglas-fir tussock moth
in the Northern Region, 1973

<u>Area</u>	<u>Acres</u>
<u>Washington</u>	
Private lands along Columbia River	5,200
<u>Idaho</u>	
Coeur d'Alene National Forest	1,800
Adjoining State and private lands	80
St. Joe National Forest	20,000
Adjoining State and Private lands	50,000
Clearwater National Forest	0
Adjoining State and private lands	120
Private lands south of Lewiston	4,000
Nezperce National Forest	23,000
<u>Montana</u>	
Lolo National Forest	50
Adjoining State and private lands	<u>300</u>
Northern Region Total	104,550

In June 1973, the insecticide Sevin-4-oil (Carbaryl) was sprayed from a helicopter on three 60-acre plots in Benewah and Latah Counties, Idaho, to test its effectiveness against the Douglas-fir tussock moth. It was applied at the rate of 1 pound per acre in one-half gallon of carrier. This was a cooperative venture between the State of Idaho, Department of Public Lands; Union Carbide Corporation; and the U.S. Forest Service. The results showed only about an average of 56 percent population reduction could be attributed to the insecticide (Livingston, 1973)^{1/}. However, significant amounts of foliage were saved when spray blocks were compared to untreated check blocks. Tussock moth population densities on these plots were quite low (50 to 80 insects per 1,000 square inches of foliage) in comparison to populations reported in other epidemics.

^{1/} Personal communication, Ladd Livingston, Idaho Department of Public Lands.

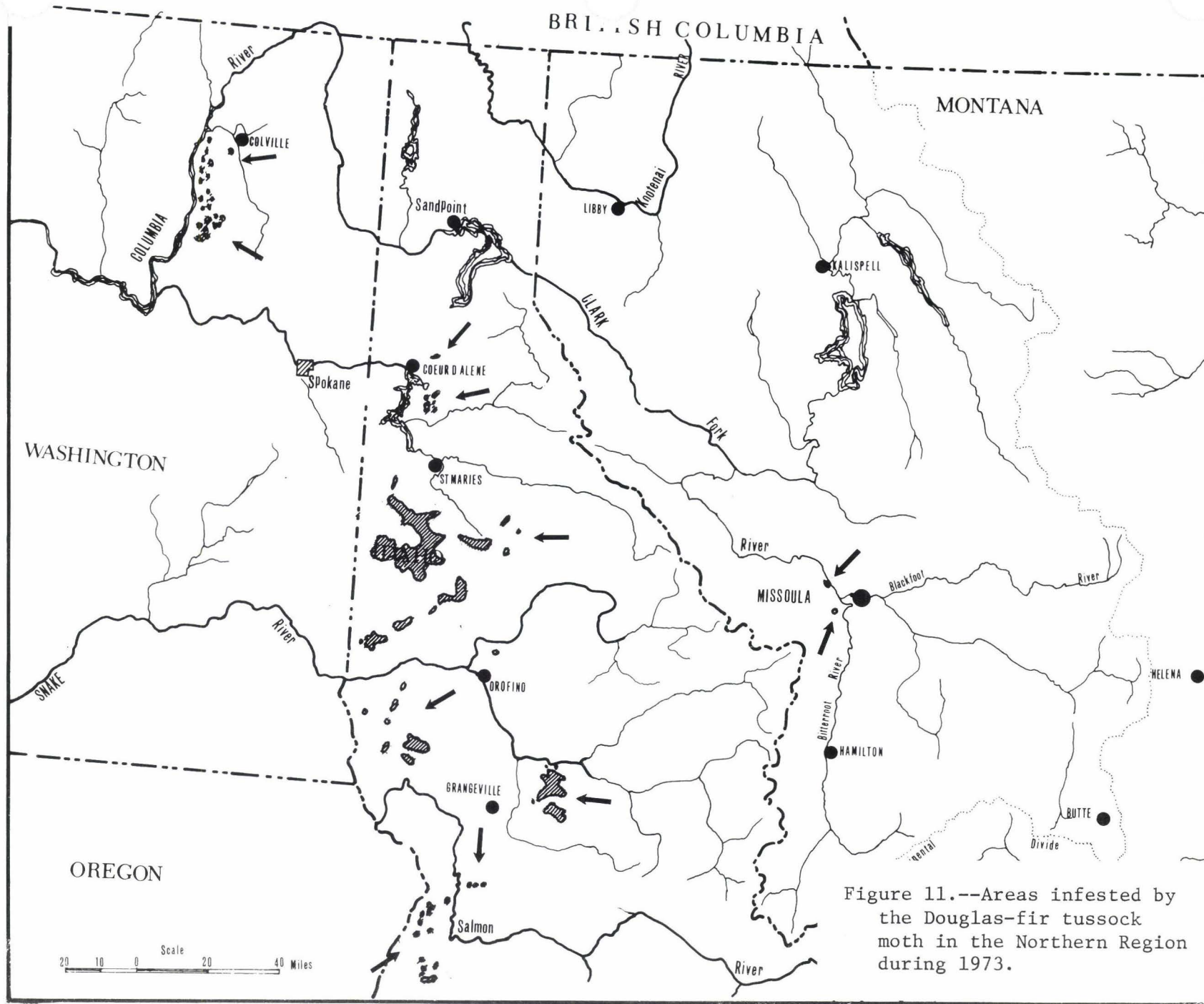


Figure 11.--Areas infested by the Douglas-fir tussock moth in the Northern Region during 1973.

DISCUSSION

Douglas-fir tussock moth outbreaks have followed a cyclic pattern in the forests of the Northern Region. Defoliation in forested areas is usually preceded by 1 to 2 years' of defoliation of individual ornamental trees in urban areas. Outbreaks in forested areas continue from 2 to 4 years in the Northern Region. A typical outbreak goes through a buildup phase the first year, an outbreak phase the second year, and a declining phase the third year due to parasitism and/or polyhedrosis virus. However, it may take an outbreak 2 years to build up, such as the 1961-65 outbreak in northern Idaho, or natural control agents may wipe out a population at the end of the second year, which happened during the 1954-55 outbreak in northern Idaho.

Three of the five recorded outbreaks in the Northern Region include commercial forest lands in Benewah and Latah Counties, Idaho. These are the 1944-47, 1961-65, and 1973- outbreaks. Defoliation maps prepared by survey personnel indicate that the same general areas were infested each time (figs. 4, 9, and 11) indicating that this region may be a warning zone for predicting Douglas-fir tussock moth epidemics. For some unknown reason, populations are released there first. This knowledge was helpful in locating egg mass sample plots for predicting the 1973 outbreak.

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☆U.S. GOVERNMENT PRINTING OFFICE: 1973-799-634/27